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Inventors: Satoshi Yoshizawa et al.
Title: Method and Apparatus for Managing Quality of Service in Network Devices
Sheets of drawings 1 of 12

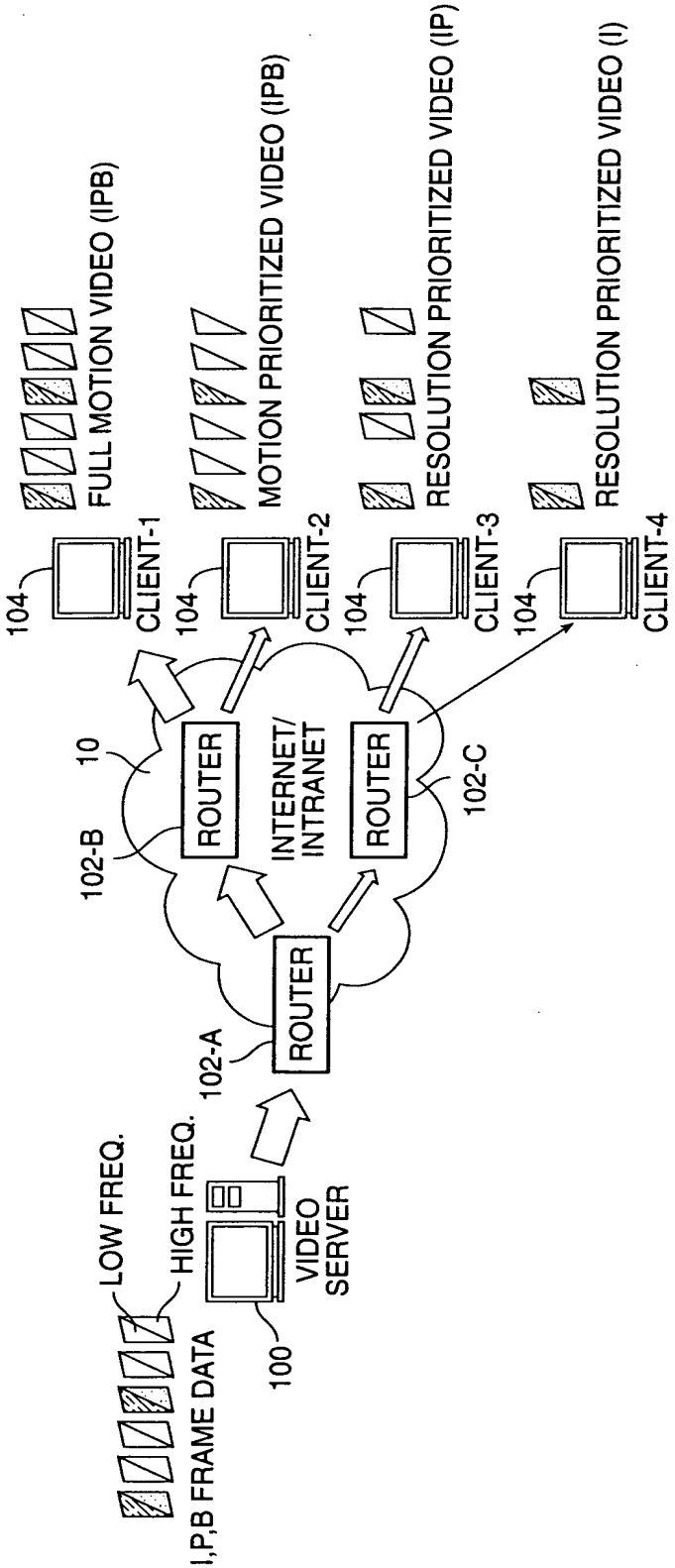

FIG. 1

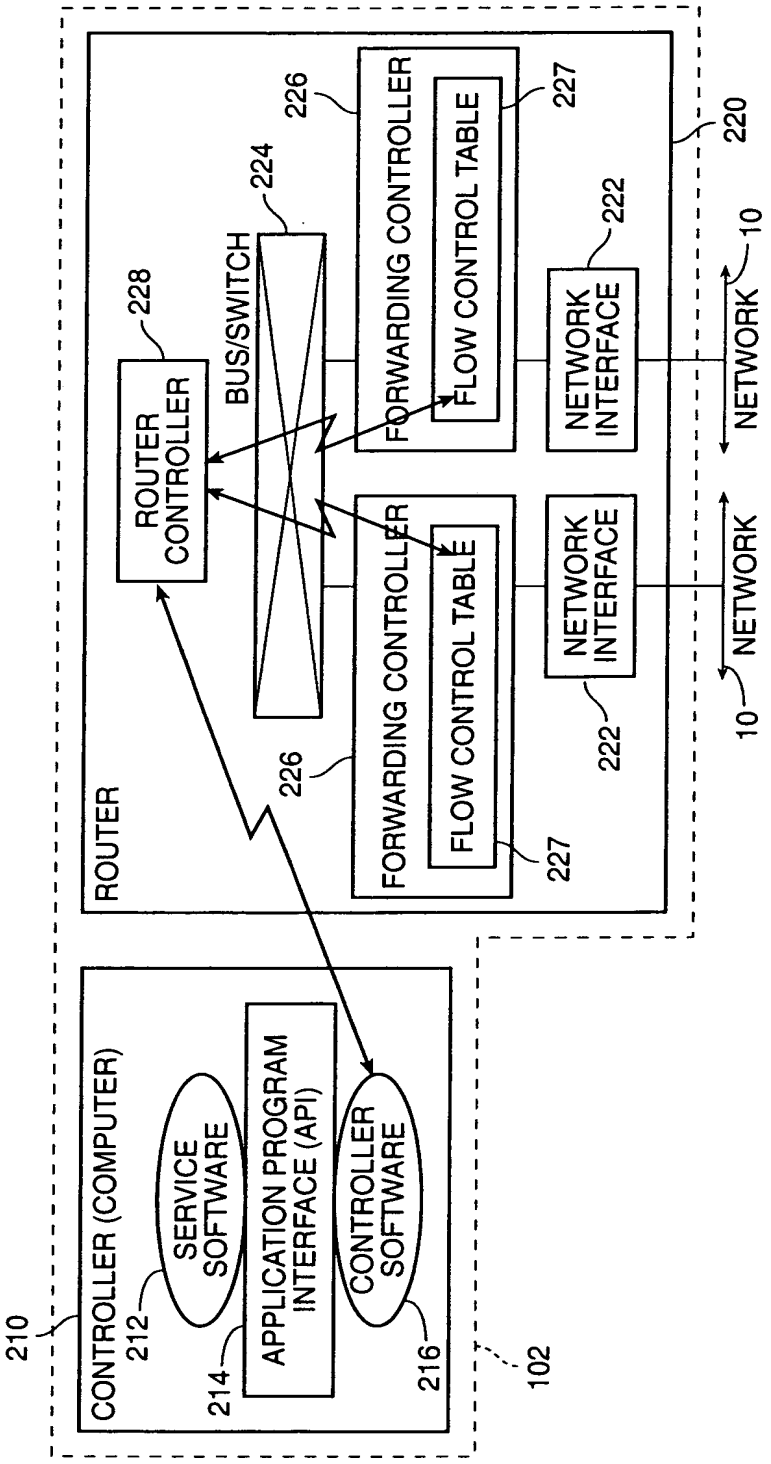
210
CONTROLLER (COMPUTER)
212
SERVICE SOFTWARE
214
APPLICATION PROGRAM INTERFACE (API)
216
CONTROLLER SOFTWARE
102
ROUTER
228
ROUTER CONTROLLER
224
BUS/SWITCH
226
FORWARDING CONTROLLER
227
FLOW CONTROL TABLE
222
NETWORK INTERFACE
220
10
NETWORK

FIG. 2

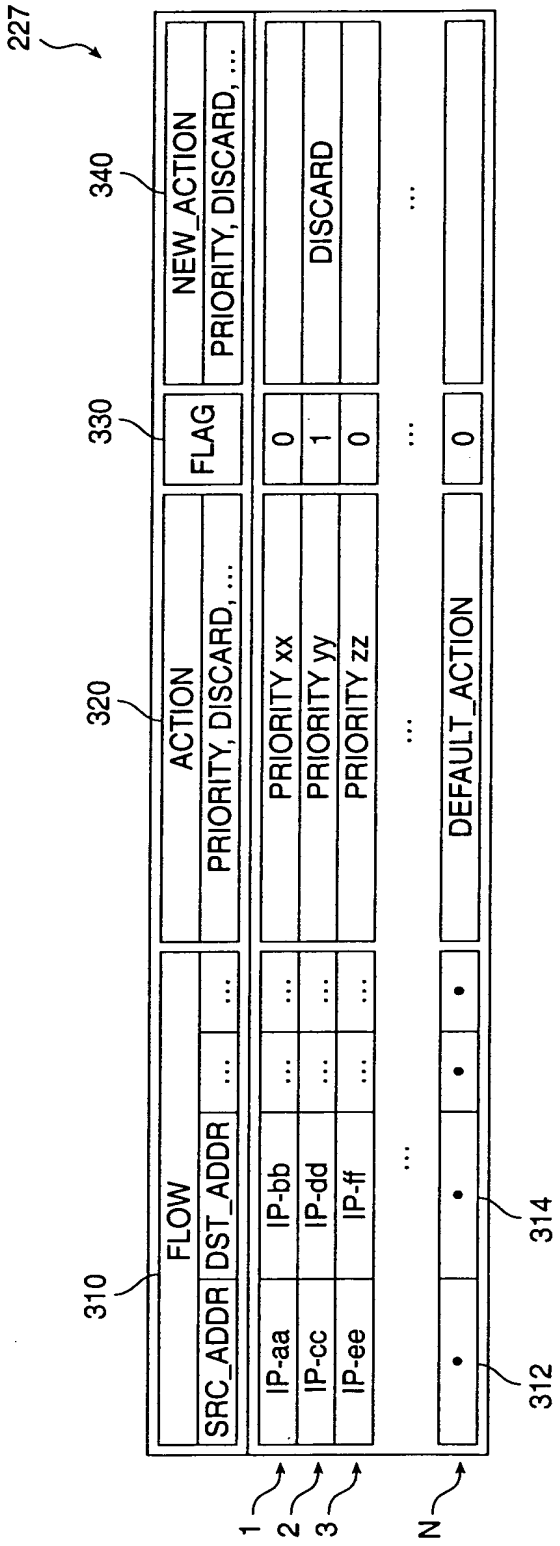
227
310
320
330
340
FLOW
SRC_ADDR
DST_ADDR
ACTION
PRIORITY, DISCARD, ...
FLAG
NEW_ACTION
PRIORITY, DISCARD, ...
IP-aa
IP-cc
IP-ee
IP-bb
IP-dd
IP-ff
PRIORITY xx
PRIORITY yy
PRIORITY zz
0
1
0
DISCARD
DEFAULT_ACTION
0
312
314
1
2
3
N

FIG. 3

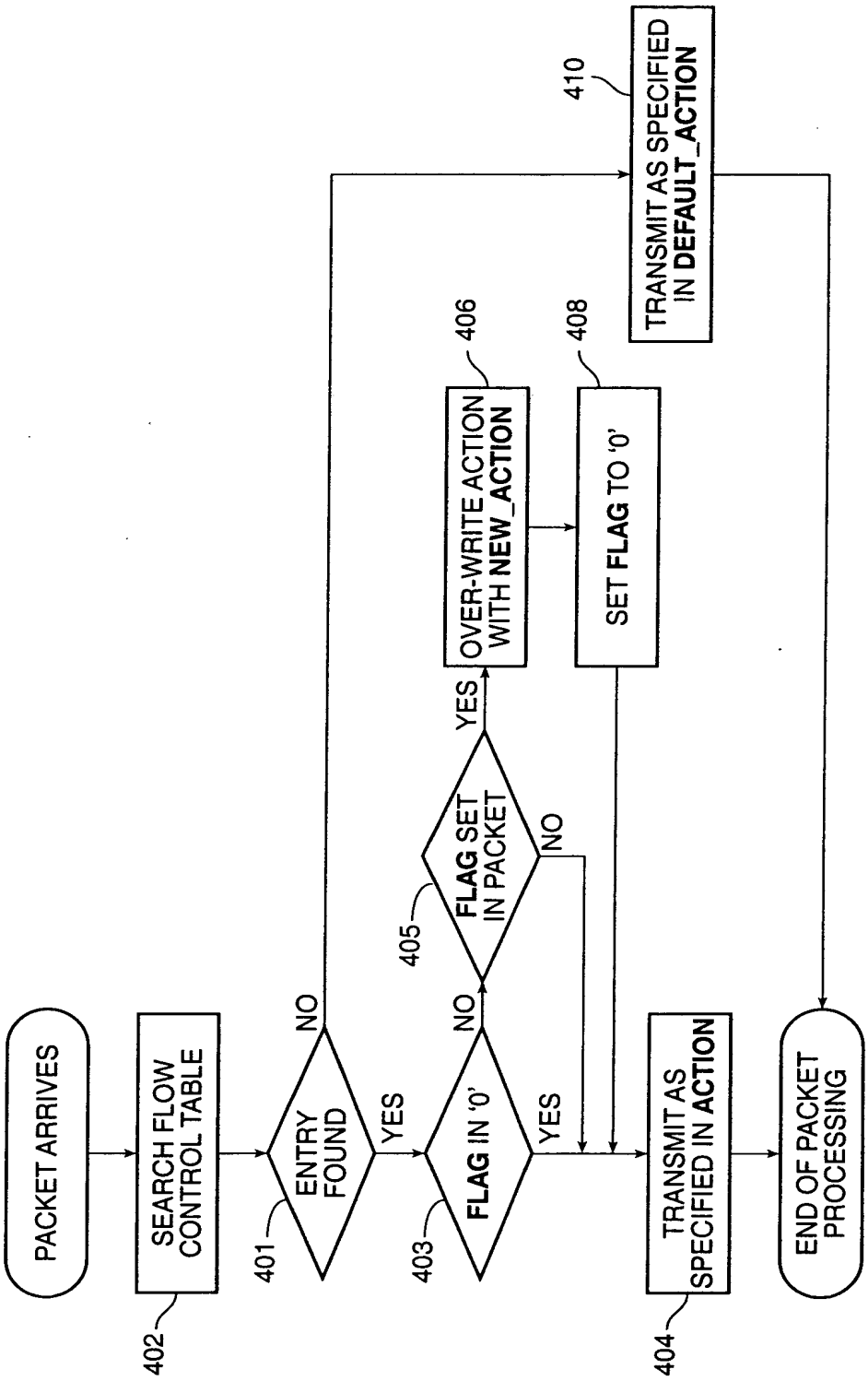
PACKET ARRIVES
SEARCH FLOW CONTROL TABLE
402
ENTRY FOUND
401
NO
YES
FLAG IN '0'
403
NO
YES
FLAG SET IN PACKET
405
YES
NO
OVER-WRITE ACTION WITH NEW_ACTION
406
SET FLAG TO '0'
408
TRANSMIT AS SPECIFIED IN DEFAULT_ACTION
410
TRANSMIT AS SPECIFIED IN ACTION
404
END OF PACKET PROCESSING

FIG. 4

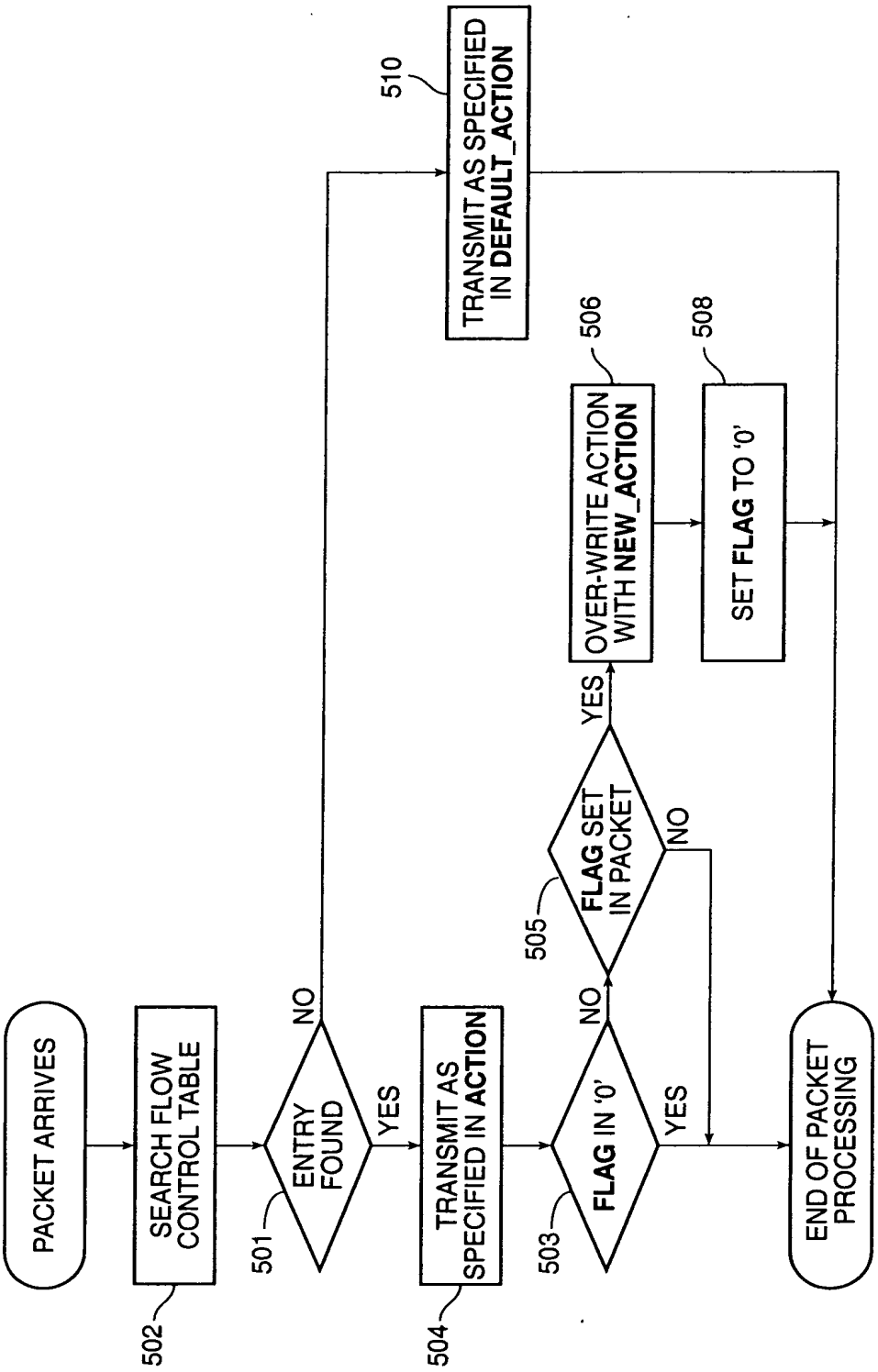
PACKET ARRIVES
SEARCH FLOW CONTROL TABLE
502
ENTRY FOUND
501
NO
YES
TRANSMIT AS SPECIFIED IN ACTION
504
FLAG IN '0'
503
NO
YES
FLAG SET IN PACKET
505
NO
YES
OVER-WRITE ACTION WITH NEW_ACTION
506
SET FLAG TO '0'
508
TRANSMIT AS SPECIFIED IN DEFAULT_ACTION
510
END OF PACKET PROCESSING

FIG. 5

```
struct END_POINT {
        IP_ADDRESS          ipaddr ;        /* may be range of addresses  */
        unsigned short      port ;          /* may be range of ports      */
         ...
} ;

struct FLOW {
        END_POINT           source ;
        END_POINT           destination ;
         ...
        octet               protocol_id ;
         ...
} ;

struct ACTION {
         ...
        /* Specify priority, mode (DISCARD), etc), etc.                    */
        /* Could be a list, relating values of particular packet field to an ACTION  */
         ...
} ;

enum FLAG { CHANGE_IMMEDIATE, CHANGE_SYNCHRONOUS } ;

boolean Set_QoS ( in FLOW target_flow, in ACTION new_action, in FLAG flag ) ;
```

FIG. 6

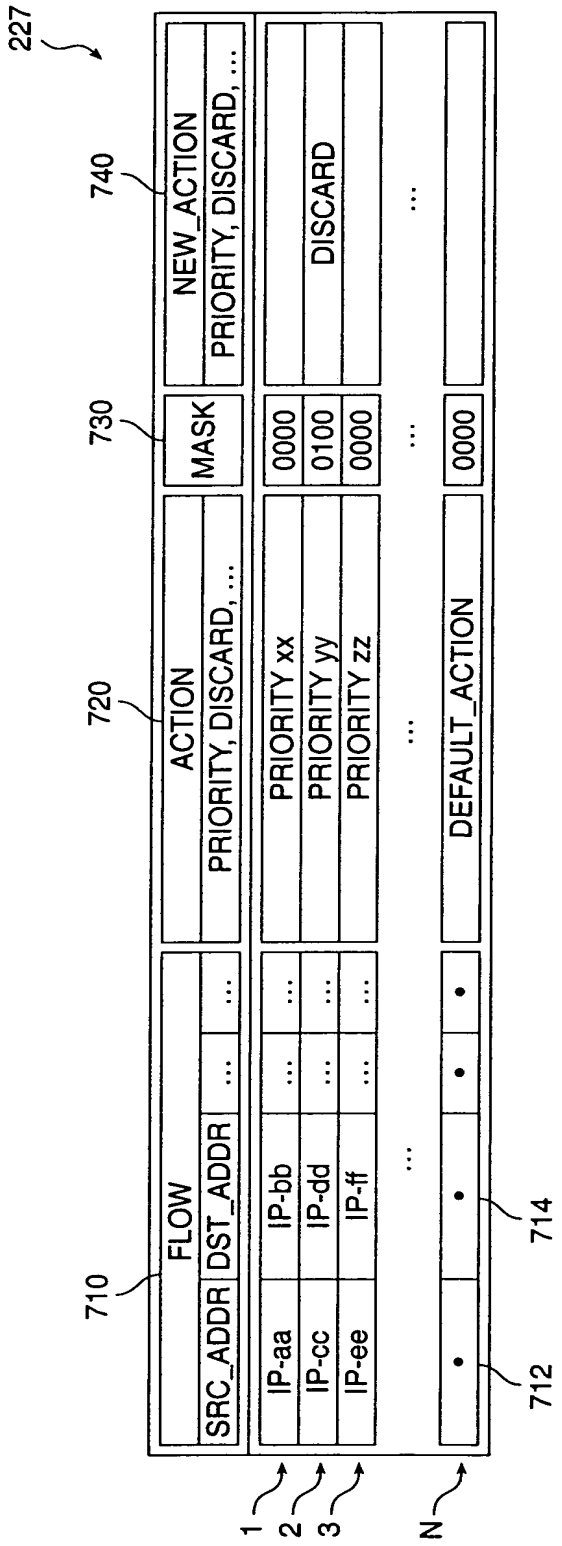
227
740
730
720
710
714
712
NEW_ACTION
PRIORITY, DISCARD, ...
MASK
ACTION
PRIORITY, DISCARD, ...
FLOW
SRC_ADDR
DST_ADDR
...
IP-aa
IP-cc
IP-ee
IP-bb
IP-dd
IP-ff
PRIORITY xx
PRIORITY yy
PRIORITY zz
0000
0100
0000
DISCARD
DEFAULT_ACTION
0000
1
2
3
N

FIG. 7

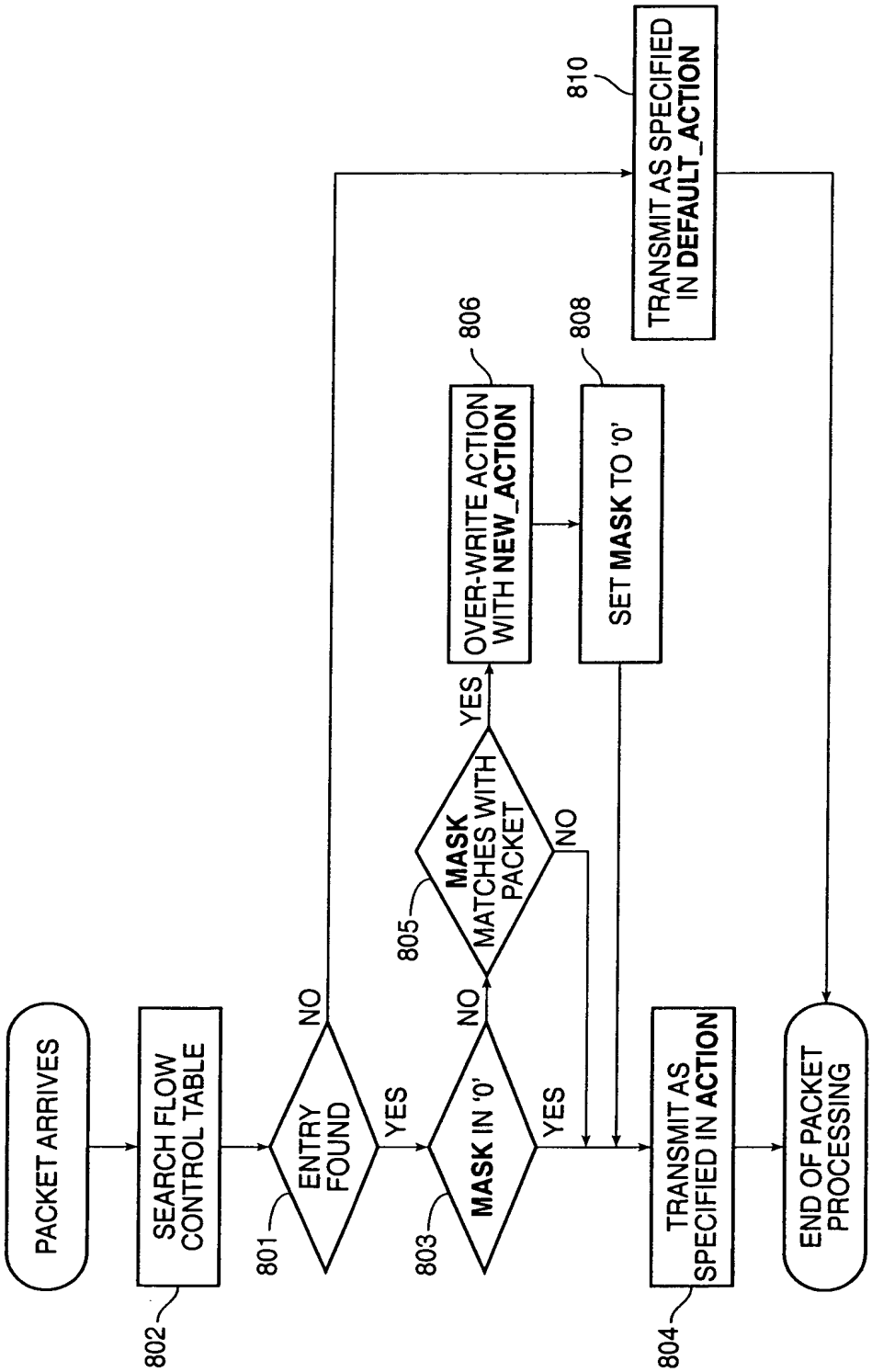
PACKET ARRIVES
SEARCH FLOW CONTROL TABLE
802
ENTRY FOUND
801
NO
YES
MASK IN '0'
803
NO
YES
MASK MATCHES WITH PACKET
805
YES
NO
OVER-WRITE ACTION WITH NEW_ACTION
806
SET MASK TO '0'
808
TRANSMIT AS SPECIFIED IN DEFAULT_ACTION
810
TRANSMIT AS SPECIFIED IN ACTION
804
END OF PACKET PROCESSING

FIG. 8

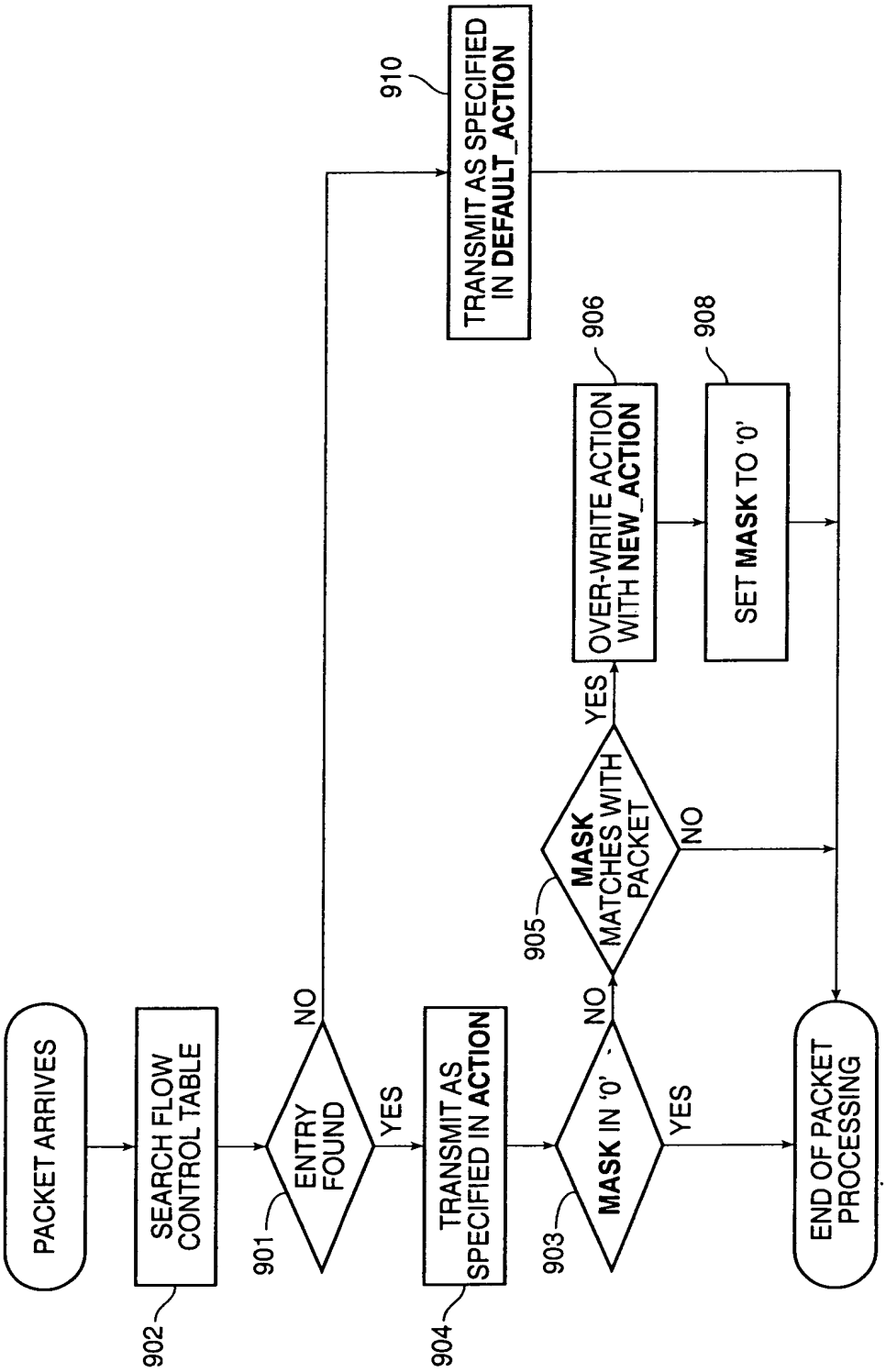
PACKET ARRIVES
SEARCH FLOW CONTROL TABLE
902
ENTRY FOUND
901
NO
YES
TRANSMIT AS SPECIFIED IN ACTION
904
MASK IN '0'
903
NO
YES
MASK MATCHES WITH PACKET
905
NO
YES
OVER-WRITE ACTION WITH NEW_ACTION
906
SET MASK TO '0'
908
TRANSMIT AS SPECIFIED IN DEFAULT_ACTION
910
END OF PACKET PROCESSING

FIG. 9

```
boolean Set_QoS ( in FLOW target_flow, in ACTION new_action, in octet mask ) ;
```

FIG. 10

```
enum HEADER_FIELD { TOS_FIELD, ... } ;

typedef sequence<octet>     FIELD_VALUE ;

struct PAYLOAD_FIELD {
        unsigned short      offset_position ;
        unsigned short      field_field ;
} ;

enum MASK_POSITION { IN_HEADER, IN_PAYLOAD } ;

union MASK switch (MASK_POSITION) {
    case IN_HEADER:
        HEADER_FIELD        target_header_field ;
        FIELD_VALUE         field_value ;
    case IN_PAYLOAD ;
        PAYLOAD_FIELD       target_payload_field ;
        FIELD_VALUE         field_value ;
} ;

boolean Set_QoS ( in FLOW target_flow, in ACTION new_action, in MASK mask ) ;
```

FIG. 11

```
boolean Set_QoS ( in FLOW target_flow, in ACTION new_action ) ;

boolean Commit_Change ( in MASK mask ) ;
```

FIG. 12

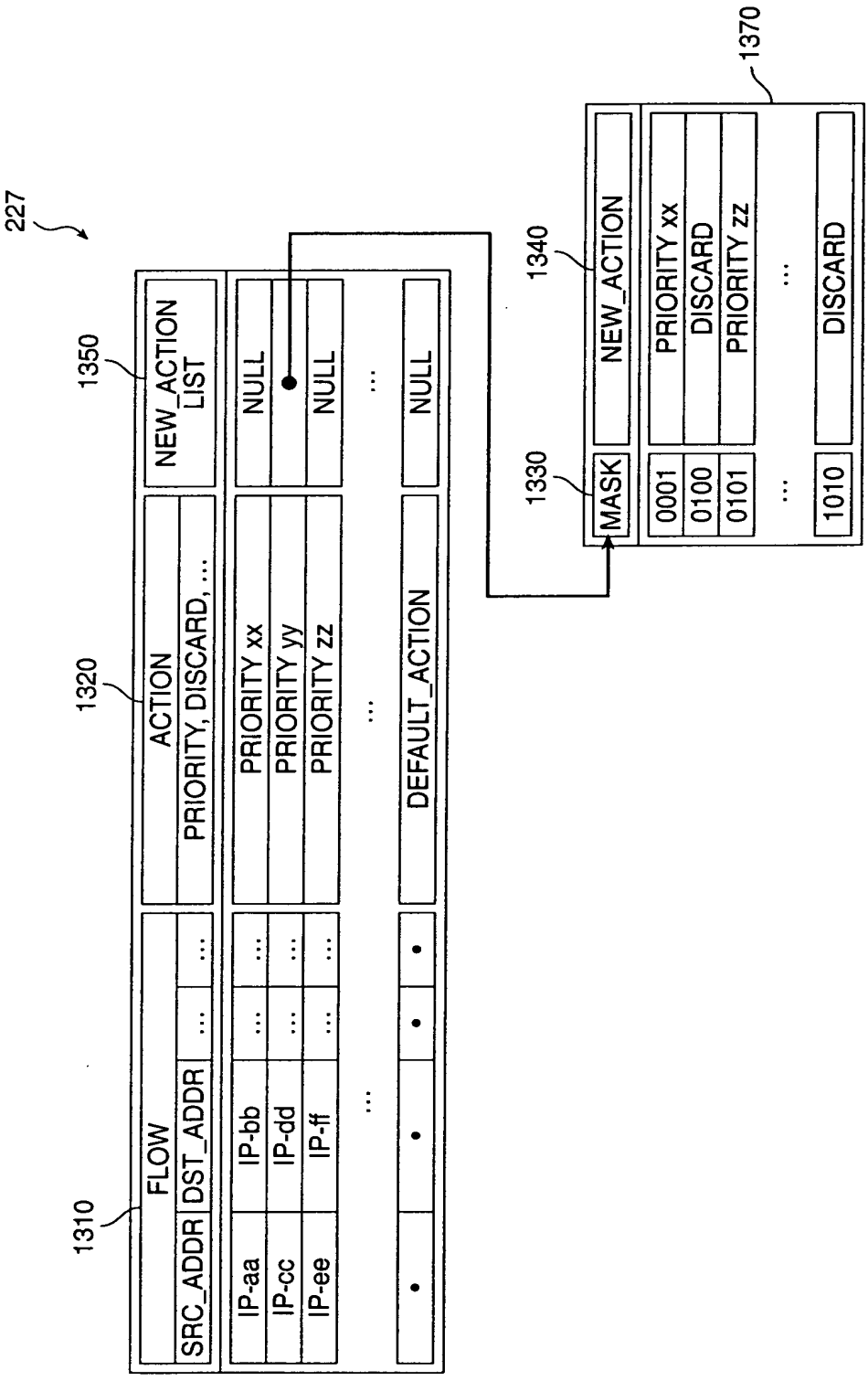
227
1310
1320
1330
1340
1350
1370
FLOW
SRC_ADDR
DST_ADDR
ACTION
PRIORITY, DISCARD, ...
NEW_ACTION LIST
IP-aa
IP-bb
IP-cc
IP-dd
IP-ee
IP-ff
PRIORITY xx
PRIORITY yy
PRIORITY zz
NULL
DEFAULT_ACTION
MASK
NEW_ACTION
0001
0100
0101
1010
PRIORITY xx
DISCARD
PRIORITY zz
DISCARD

FIG. 13

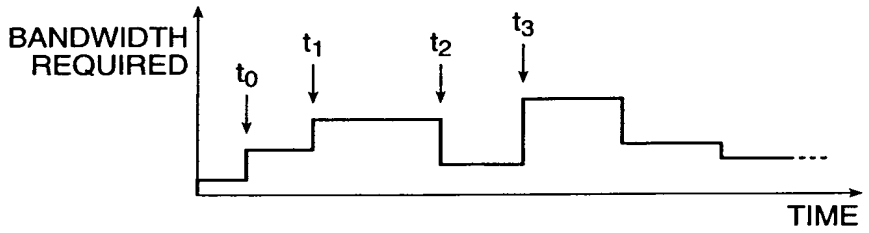

FIG. 14

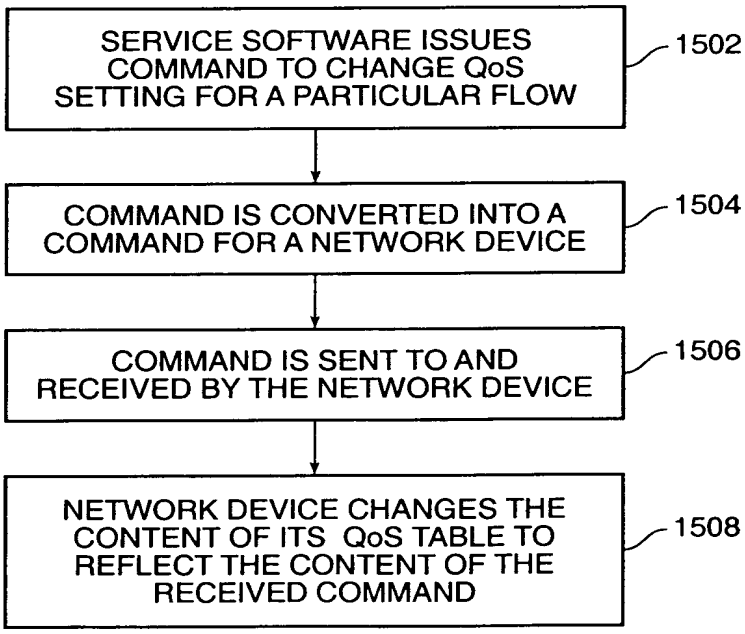

FIG. 15 PRIOR ART